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AUTHOR Lehman, Elyse Brauch: Hanzel, Sharron Hurtt
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ABSTRACT

In order to determine whether there are developmental differences in the handling of the modality attribute 32 children from each of grades two and six and 32 college students were presented with a video-taped mixed-modality list of 32 first grade words. Subjects were asked to recall the words, to identify the presentation modality of each word on a recognition test, and to indicate on a 3-point rating scale how confident they were that each of their modality identifications (MI) was correct. Results show that there were no overall developmental changes in the identification of modality while children as well as adults demonstrated the ability to judge the accuracy of their modality identifications, adults not only recalled more words than children but also were the only group to organize their recall by representation modality. Findings suggest that information about the input mode of an event is a part of long-term mnemonic code for both adults and young children and that such information may be coded "automatically" in all age groups. (Author/MP)

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A Developmental Study of Memory for Presentation Modality

Elyse Brauch Lehman and Sharron Hurtt Hanzel

George Mason University

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A goal of recent research on memory has been to discover which attributes of events children encode and store in order to better understand developmental changes in the structure of the mnemonic code. We know, for example, that children are quite likely to include in their memory representations information about how recently an object was seen and about its spatial location. They are less likely, on the other hand, to encode certain kinds of semantic information, e.g., connotative aspects of meaning such as sense impression. The picture, however, is far from complete, and requires an expanded data base involving other attributes and measures (Kail and Siegel, 1977).

The research to be reported today focuses on developmental differences in the handling of the modality attribute. While it is clear that adults often retain information about whether a word has been seen or heard for at least several minutes after presentation (Bray and Batchelder, 1972), we do not know how readily children encode such information. Douglas and Cathcart's (1977) study of modality encoding using a release from proactive inhibition task does suggest that input mode is stored by children as young as second grade. It does not, however, allow us to know if this ability improves with age, whether children can monitor their memory for modality, or how such encoding occurs. These questions were the focus of the present study.

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METHOD

Thirty-two children from each of grades two and six and 32 college students were presented with a video-taped mixed-modality list of 32 first grade words with instructions to remember the words for later recall. In addition, half of the subjects knew in advance that they were to also remember input mode, while the others were not given these directions. The visual words were each exposed for 2 seconds, followed by a 2 second blank interval. The 4 second interval from the beginning of one presentation to the next was used for the auditory words as well.

Subjects were then asked to recall the words, to identify the presentation modality of each word on a recognition test, and to indicate on a 3-point rating scale (very sure, sort of sure, guessing) how confident they were that each of their modality identifications (MI) was correct. For the MI task a new set of materials was produced by randomly combining 32 distractor words with the 32 target words. Each word was typed in upper-case letters on a white 3" x 5" card. These words were both shown and read aloud by the experimenter, and subjects responded whether the word had been "seen before, heard before, or was brand new," and how sure they were about each judgment.

RESULTS

Modality Identification

The major finding was that there were no overall developmental changes in the identification of modality. Retention of modality information was well above chance even for second-graders. The high levels of accuracy on the MI task did not depend on prior instructions to attend to input mode, although they were more likely to occur for words that were recalled than for words that were not, an effect which tended to occur more often in adults than in children.

The upper part of Table 1 indicates that at all grade levels subjects correctly identified the modality of the target words approximately 70% of the time. When the observed proportions for each condition were compared with their appropriate guessing rates, all were significantly higher than chance. The closest to chance was the simple proportion for second graders in the incidental auditory condition (guessing rate = .49), and a t test indicated that even this difference was statistically significant ($t(15) = 2.87$, $p<.01$).

Table 1 also shows, however, that adults had higher false alarm rates to the distractor words than did children. Since they were more likely to label a word as "old," their simple proportions may be artifically inflated. We, therefore, looked at MI only for words that had been correctly identified as "old." A glance at these conditional proportions in Table 2, as well as at the simple proportions in Table 1, indicates that grade level, instructions, and presentation mode has little effect on memory for presentation modality. A grade x instructions x sex x presentation mode analysis of variance on these conditional proportions confirmed that neither the main effects nor any interactions with these factors were statistically significant. On the other hand, when the data were divided into recalled versus not recalled words (pooled over modality), a 4-way analysis of variance on the conditional proportions showed that MI was higher for recalled than for not recalled words ($F(1,84) = 5.16$, $p<.05$) and that this difference tended to be larger for adults than for children (proportions: $F(2,84 = 2.60$, $p<.10$; arc sines: $F(2,84 = 4.11$, $p<.05$). That is, MI decreased somewhat with increasing age for not-recalled words, although no age changes occurred for words that were recalled.

Recall

Adults not only recalled more words than children (see Table 2: $F(2,84) = 48.22$, $p<.01$), they also were the only group to organize their recall by presentation modality. The mean Frankel and Cole (1971) z-scores were -.01, .16, and -0.32 for grades 2, 6, and college respectively. Only the value for adults differed significantly from zero ($t(31) = -1.90$, $<p.05$).

Confidence Ratings

Both groups of children as well as adults demonstrated the ability to judge the accuracy of their modality identifications. Figure 1, which shows the probability of correct MI (conditional proportions) given a particular confidence rating, indicates that subjects performed better on the MI task when they felt very sure of their judgment (a #3 rating) than when they said they were guessing (a #1 rating). On the other hand, the slope of the young children's curve was not as steep as the curves for the older children and adults. Second graders correctly recalled a fair amount of modality information even when they said they were guessing.

DISCUSSION

The results show that children readily store information about whether a word was seen or heard for several minutes after presentation even under incidental learning conditions, and that they do so as well as adults. Seven-year-olds can also assess how well they are retrieving information about modality, although they are somewhat less accurate than older subjects in making the judgments. These findings suggest that information about the input mode of an event is a part of the long-term mnemonic code for both adults and young children and that such information may be coded "automatically" in all age groups. Furthermore, the relationship between item recall and modality identification suggests that these two kinds of information may

be stored as a unit and remembered or forgotten together. Whether an increasing relationship with age between storage of item and modality attributes is a reliable finding awaits further research. It is clear, however, that memory representations do contain a great deal of information about input mode, and developmental models of memory will need to take into account these and other findings of long-term storage of sensory features.

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Table 1

Modality Identification (Simple Proportions) and False Alarm Rates as a Function of Grade, Instructions, and Modality

	Incidental		Intentional		
	A	V	A	V	Mean
All words					
2	.62	.69	.66	.73	.67
6	.67	.68	.71	.67	.68
College	.70	.71	.77	.66	.71
Mean	.66	.69	.71	.69	.69
Recalled words					
2	.76	.84	.88	.89	.84
6	.86	.90	.83	.77	.84
College	.83	.86	.85	.84	.84
Mean	.82	.87	.85	.83	.84
Not recalled words					
2	.59	.63	.62	.67	.63
6	.57	.56	.65	.63	.60
College	.56	.59	.72	.57	.61
Mean	.57	.59	.66	.62	.61
False alarms (new)					
2	.17	.12	.11	.10	.13
6	.20	.12	.17	.09	.15
College	.32	.16	.23	.23	.24
Mean	.23	.13	.17	.14	.17

Table 2

Modality Identification (Conditional Proportions) and Recall Performance as a Function of Grade, Instructions, and Modality

	Incidental		Intentional		
	A	V	A	V	Mean
All words					
2	.79	.82	.87	.87	.84
6	.83	.82	.83	.79	.82
College	.79	.82	.85	.76	.81
Mean	.80	.82	.85	.81	.82
Recalled words					
2	.76	.84	.88	.90	.85
6	.87	.91	.88	.78	.86
College	.84	.86	.88	.84	.86
Mean	.82	.87	.88	.84	.85
Not recalled words					
2	.82	.79	.89	.85	.84
6	.82	.76	.84	.80	.81
College	.70	.79	.84	.69	.76
Mean	.78	.78	86	.78	.80
Words recalled					
2	3.25	3.94	2.88	4.19	7.13
6	5.56	5.56	5.69	5.38	11.10
College	8.00	8.00	6.75	6.81	14.78
Mean	5.60	5.83	5.11	5.46	11.00

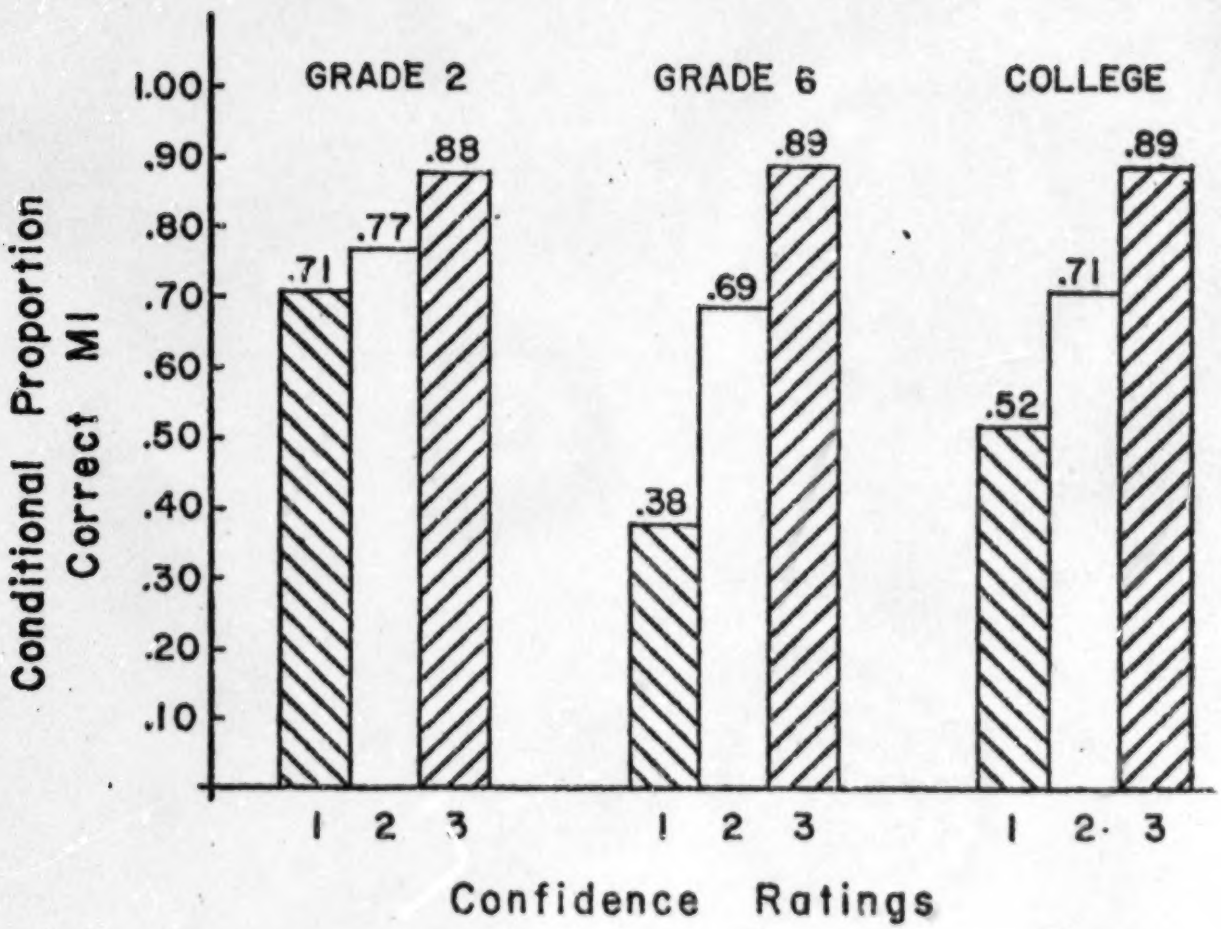

Figure 1. Probability of correct modality identification for each confidence rating as a function of grade. 1=a guess; 2=somewhat certain; 3=very certain.